with surgical bypass, with shorter hospitalizations in symptomatic and asymptomatic patients. Further long-term follow-up is required to compare these two treatment modalities for durability to determine the optimal popliteal aneurysm management.

Multifactorial Disease Severity Score (DSS) Predicting the Success of Endovascular Intervention of Femoropopliteal Peripheral Arterial Disease

In-Kyong Kim, MD,[1] Natalia Egorova, PhD,[2] Andrew J. Meltzer, MD,[3] James F. McKinsey, MD[1]. [1]Columbia University, New York Presbyterian Hospital System, New York; [2]Mount Sinai University, New York; and [3]New York Presbyterian Hospital, New York, NY

Objective(s): The goal was to create a multifactorial Disease Severity Score (DSS) for characterization of femoropopliteal arterial lesions. By having a greater understanding of the effect of patient comorbidities and an in-depth method to characterize an arterial lesion, we may be able to better compare lesions in different studies and predict which therapy is most appropriate for each lesion undergoing an endovascular intervention (EVI).

Methods: We evaluated 44 lesion and patient characteristics in our prospectively maintained lower extremity arterial lesion database from 2005 to 2009 to create a gradated DSS.

Results: We identified 1329 femoropopliteal lesions in 675 patients. Statistical analysis by multivariable Cox proportional hazards model identified 16 variables that impact patency: seven lesion characteristics (Table I) and nine patient characteristics or comorbidities (Table II). Factors with the most impact were a chronic total occlusion (DSS 16), lesion length >100 mm (DSS 13), and no runoff vessels and stenosis of 80% to 99% (DSS 9). The following factors were considered baseline, or score of 0: stenosis <80%, lesion length <100 mm, and three-vessel runoff. By adding these variable scores, a DSS was created and used to predict patency of the EVI.

Conclusions: The presence of a chronic total occlusion, lesion length >100 mm, poor runoff, and the presence of congestive heart failure have the most dramatic effect on patency after EVI. A comprehensive DSS allows for the in-depth classification of lesion characteristics and factors that predict success of EVI and can allow for comparison of distinct lesions. Future comparisons of effectiveness of treatment modalities can be possible.

Table I. Significant femoropopliteal lesion characteristics that negatively impact patency after endovascular intervention

Factor	*Score*	*HR (95% CI)*
Chronic total occlusion	16	1.73 (1.28-2.33)
Stenosis 80%-90%	9	1.38 (1.06-1.78
Lesion length ≥100 mm	13	1.55 (1.25-1.93)
Vessel runoff		
0	9	1.36 (0.95-1.96)
1	7	1.29 (0.96-1.73)
2	1	1.04 (0.77-1.40)
Lesion calcification	1	1.04 (0.82-1.31)

CI, Confidence interval; *HR,* hazard ratio.

Table II. Patient characteristics that impact patency after endovascular intervention

Factor (N = 16)	*Score*	*Cox coefficient*	*HR (95% CI)*
CHF	8	0.274	1.32 (0.99-1.74)
Female sex	7	0.227	1.25 (0.96-1.63)
Current smoker	7	0.234	1.26 (0.80-1.99)
Former smoker	3	0.121	1.13 (0.85-1.50)
Diabetes	6	0.199	1.22 (0.94-1.58)
CAD	4	0.147	1.16 (0.88-1.53)
Renal	4	0.140	1.15 (0.85-1.55)
Age, years			
50-64	6	0.195	1.22 (0.84-1.76)
65-79	−2	−0.075	0.93 (0.69-1.25)

CAD, Coronary artery disease; *CHF*, congestive heart failure; *CI*, confidence interval; HR, hazard ratio.

Defining the Role of Endovascular Therapy in Critical Limb Ischemia With Tissue Loss

Andrew J. Meltzer, MD, Gisberto Evangelisti, MD, Ashley Graham, Francesco Aiello, MD, Peter H. Connolly, MD, Harry L. Bush, MD, John K. Karwowski, MD, Darren B. Schneider, MD. New York Presbyterian Hospital, New York, NY

Objective(s): We compare the utility of endovascular therapy (ET) with bypass surgery for critical limb ischemia (CLI) with tissue loss and identify risk factors for failure of ET.

Table.

	Hazard ratio (HR/ AOR)	*95% CI for HR/ AOR*	P *value*
Overall survival			
Dialysis dependence	3.0	1.1–81.	.03
Angina	5.1	1.3–20.3	.02
COPD	3.8	1.8–8.3	.001
Amputation free survival			
Rutherford 6	3.6	1.4–9.2	.007
COPD	3.6	1.3–9.6	.01
Limb salvage			
Rutherford 6	35.1	5.4–231	<.0001
Wound healing at 12 months			
Diabetes	7.0	1.4–36	.02
Current smoking	5.3	1.1–26	.04
Patency loss	4.8	1.1–22	.04

Methods: A retrospective review (2004 to 2010) of patients undergoing ET for tissue loss (Rutherford class 5 and 6) provided data for multivariate models of overall survival, amputation-free survival (AFS), limb salvage, and wound healing. Comparisons were made with a bypass surgery cohort matched for tissue loss.

Results: Ninety-four patients underwent ET (58% TransAtlantic InterSociety Concensus [TASC] C/D; 44% tibial) for Rutherford 5 (88%) or Rutherford 6 (12%) CLI with tissue loss of the heel (15%), forefoot (16%), toe(s) (43%), calf/ankle (11%), or multiple locations (15%). Sustained limb salvage was 83% ± 5%. Overall survival was 44% ± 7% and AFS was 40% ± 7% at 2 years. Predictors of failure by multivariate models are reported in the Table. Comparison between the Rutherford 5 WRsubgroup (n = 83) and an Rutherford 5 bypass cohort (n = 66), suggest equivalent limb salvage, with reduced AFS ($P = .04$) and a trend toward reduced overall survival ($P = .09$). Early would healing was higher after bypass: 43% vs 11% at 3 months ($P = .001$) and 57% vs 30% at 6 months ($P = .01$).

Conclusions: Given the short life expectancy of patients with tissue loss, ET permits sustained limb salvage in patients at high risk for bypass (particularly Rutherford 5). However, wound healing is slow compared with bypass and requires sustained patency.

Midterm Results of Limb Salvage and Stent Patency with Popliteal Artery Stenting Across the Knee Joint

Aleksandra Policha, MD,[1] Neil Moudgill, MD,[2] Lily Chang, BS,[3] Anumeha Whisenhunt, DO,[2] Shawn Pierce, CRNP,[2] Luis Eraso, MD,[4] Paul DiMuzio, MD,[2] Atul Rao, MD,[2] Joshua Eisenberg, MD[2]. [1]Department of General Surgery and [2]Division of Vascular and Endovascular Surgery, Thomas Jefferson University Hospital, Philadelphia, Pa; [3]Thomas Jefferson University College of Medicine, Philadelphia, Pa; and [4]Division of Vascular Medicine, Thomas Jefferson University Hospital, Philadelphia, Pa

Objective(s): This study evaluated the relationship of stent location on limb salvage and stent patency in patients undergoing popliteal artery stenting.

Methods: We performed a retrospective review of a prospectively collected database, identifying all patients undergoing popliteal artery stenting between September 2009 and February 2012. Patients were divided into two groups based on the position of the distal end of the stent in relation to the knee joint. The proximal popliteal stent group included patients receiving a stent ending above the patella (above the flexion point of the knee). The distal popliteal stent group included patients receiving a stent(s) ending below the patella (in the flexion zone). Data collected included demographics, indication for surgery,

intraoperative findings, and follow-up duration. The outcomes studied were limb salvage and primary stent patency. Continuous data were analyzed with a *t* test, and categoric data were analyzed with a χ^2 test.

Results: We identified 40 patients in the proximal stent group and 56 in the distal stent group. Follow-up imaging data were available for 82 patients. The two groups did not differ in demographics, mean number of patent runoff vessels (proximal, 2.0 vessels; distal, 1.8 vessels; $P = .18$), or mean duration of follow-up (proximal, 259 days; distal, 257 days; $P = .98$). Claudication was more often an indication for popliteal stent placement in the proximal group (42% vs 16%; $P = .004$). Limb-threatening ischemia was more frequently an indication for stent placement in the distal group (75% vs 55%; $P = .04$). Limb salvage was achieved in 92.5% of proximal and in 85.7% of distal stent placements ($P = .30$). Limb salvage did not differ between the groups when only patients with limb-threatening ischemia were included in the analysis (proximal, 86%; distal, 83%; $P = .75$). Primary patency at 3 months was 57% in the proximal group vs 49% in the distal group ($P = .46$).

Conclusions: Popliteal artery stenting is associated with a high rate of limb salvage at a mean follow-up of 8 months and is an acceptable option for patients with incapacitating claudication and limb-threatening ischemia who are poor candidates for alternative interventions. Popliteal stents placed across the knee joint did not affect limb salvage or patency compared with stents placed above the knee joint.

Low Levels of High-Density Lipoproteins Are Associated With Acute Kidney Injury Following Revascularization for Chronic Limb Ischemia

Hasan H. Dosluoglu,[1,2] Pradeep Arora, MD,[1,2] Nauman Tahir, MD,[2] James W. Lohr, MD,[1,2] Purandath Lall, MBBS,[1,2] Nader D. Nader[1,2]. [1]VA Western NY Healthcare System and [2]State University of New York at Buffalo, Buffalo, NY

Objective(s): Perioperative acute kidney injury (AKI) is not uncommon in patients after extremity revascularization. High-density lipoproteins (HDL) have been shown to reduce organ injury and death in animal models via modulation of adhesion molecules and cytokines. Our aim was to examine the association of HDL and other factors on perioperative AKI in patients undergoing revascularization for symptomatic chronic limb ischemia.

Methods: All patients who underwent open or endovascular revascularization between June 2001 and December 2009 for symptomatic chronic limb ischemia (Rutherford category 3 to 6) were retrospectively analyzed. Patients on dialysis and those with incomplete data were excluded. Patients were grouped for HDL <40 or ≥40 mg/dL. Univariate and multivariate analysis were used to identify factors associated with AKI.

Results: Included were 684 patients (219 open, 465 endovascular/hybrid) with diabetes (47%) chronic kidney disease (20%), critical limb ischemia (31%), and <40 HDL (60%). Medications included statin use (57%), angiotensin converting enzyme inhibitors/angiotensin receptor blockers (53%). Postoperative AKI developed in 85 patients (12.4%), 9.4% endovascular vs 12.6% open (P = NS). The AKI group was more likely to be older (71.5 ± 10.1 vs 68.0 ± 10.8 years, $P = .01$), have diabetes (60% vs 46%, $P = .01$), be using angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (64% vs 52%, $P = .04$), and have pre-existing chronic kidney disease (36% vs 17%, $P < .001$). AKI occurred in 16% of patients with low HDL and in 7% with high HDL ($P < .001$). Multivariate analysis using logistic and propensity score showed that HDL level (hazard ratio, 2.4; 95% confidence interval, 1.4-4.2) and underlying chronic kidney disease were independent predictors of postoperative AKI ($P < .001$).

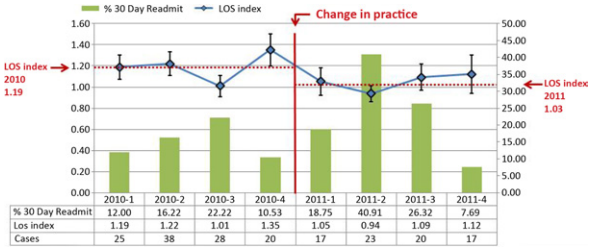
Conclusions: AKI after revascularization is not uncommon (12.4%), and lower HDL, along with chronic kidney disease, is associated with increased odds of postoperative AKI. If these observations can be verified in a prospective fashion, strategies for increasing HDL level in patients with a high risk of postoperative AKI should be investigated.

Reduction in Hospital Length of Stay for Patients Requiring Lower Extremity Amputation

Joshua Unger, MD, Daniel Geersen, PAC, Nancy Payne, RN, Lu-Anne Laws, CSW, Mary Jane Stillwagon, RN, Leila Mureebe, MD MPH, Cynthia Shortell, MD. Duke University, Durham, NC

Objective(s): This study evaluated the effect of a multidisciplinary approach and initiation of care pathways on hospital length of stay (LOS) for lower extremity amputations.

Methods: Patients undergoing lower extremity amputations (toe, below the knee, above the knee, or revision of prior amputation) between January 2010 and December 2011 were retrospectively identified by International Classification of Diseases–9th Edition codes (84.11, 84.12, 84.14, 84.15, or 84.3) in our institution's administrative database after obtaining Investigational Review Board approval. Midway through the study period, in January 2011, a multidisciplinary change in care of these patients was initiated. Among the changes made was initiation of twice-weekly rounds with representatives from vascular surgery, limb loss counseling, physical therapy, and a discharge coordinator. Patients' discharge diagnoses and medical comorbidities were analyzed by All Patient Refined Diagnosis Related Group (APR-DRG) in the University HealthSystem Consortium (UHC) Clinical Database. LOS before and after the change in practice was compared with similar patients in academic institutions nationwide via the LOS index, defined as actual LOS-to-expected LOS ratio.



	2010-1	2010-2	2010-3	2010-4	2011-1	2011-2	2011-3	2011-4
% 30 Day Readmit	12.00	16.22	22.22	10.53	18.75	40.91	26.32	7.69
Los index	1.19	1.22	1.01	1.35	1.05	0.94	1.09	1.12
Cases	25	38	28	20	17	23	20	17

Fig.

Results: During the 2-year study period, 150 patients underwent 188 amputations, including 114 amputations in 2010. After the change in practice, 74 amputations were performed in 2011. Patient demographics were consistent across the study period, including a 72% prevalence of diabetes mellitus. Average LOS was 11.1 ± 7.04 days in 2010 and decreased to 9.61 ± 6.37 days in 2011 ($P = .0621$), without a significant change in readmission rate. The crude LOS decrease was not statistically significant, but when adjusted for patient comorbidities, the LOS index was significantly decreased from 1.19 ± 0.629 in 2010 to 1.03 ± 0.547 in 2011 ($P = .0365$). LOS index was inversely related to the 30-day readmission rate (Fig). Total savings to the hospital >$150,000 for 2011.

Conclusions: A multidisciplinary partnership of physician and hospital team members resulted in a decrease in LOS of 1.5 days for patients undergoing lower extremity amputations, representing increased efficiency of care and decreased observed costs.

Association of Inflammatory and Metabolic Serum Biomarkers With Carotid Intima Media Thickness (cIMT) in a Community-Based Population: The Heart Strategies Concentrating on Risk Evaluation (Heart SCORE) Study

Rabih A. Chaer,[1] Kevin Kip,[2] Suresh Mulukutla,[1] Aiyer Aryan,[1] Steven Reis[1]. [1]University of Pittsburgh Medical Center, Pittsburgh, Pa, and [2]University of South Florida, Tampa, Fla

Objective(s): Carotid intima media thickness (cIMT) has been broadly used as a surrogate measure for cardiovascular risk but is not widely available or standardized. Our goal was to identify a set of serum biomarkers associated with cIMT independent of race and sex.

Methods: The Heart Strategies Concentrating on Risk Evaluation (SCORE) study is a prospective community-based cohort study of 2000 adults that started enrollment in 2003. Serum biomarkers of inflammation, metabolic, and endothelial function were obtained and examined in relation to cIMT, which was measured as a continuous variable and categorically with a cutoff of ≥1 mm.

Results: cMIT was measured in 697 patients (66% white, 32% black; 62% women). Cohort demographics and comorbidities are detailed in the Table. cIMT was positively associated with interleukin-6 ($R_S = 0.17$, $P < .0001$), fasting glucose ($R_S = 0.20$, $P < .0001$), and insulin ($R_S = 0.14$, $P = .0002$) levels and inversely associated with adiponectin ($R_S = -0.20$, $P < .0001$), CD40L ($R_S = -.014$, $P = .0003$), and high-density lipoprotein cholesterol ($R_S = -0.20$, $P < .0001$) levels. cIMT was not associated with endostatin, highly-selective C-reactive protein, soluble intercellular adhesion molecule, total cholesterol, low-density lipoprotein cholesterol, or triglycerides. Multiple regression analysis identified age (partial correlation [R_P] = 0.23, $P < .0001$), female sex ($R_P = -0.16$, $P < .0001$), black race ($R_P = 0.13$, $P = .0009$), body mass index ($R_P = 0.08$, $P = .04$), serum glucose ($R_P = 0.14$, $P = .0002$), high-density lipoprotein cholesterol ($R_P = -0.08$, $P = .03$), and interleukin 6 ($R_P = 0.07$, $P = .05$) were independently associated with cIMT.

Conclusions: We identified several biomarkers that are positively (interleukin-6, glucose, insulin) or inversely (adiponectin, CD40L, high-density lipoprotein) associated with cIMT. Because increased cIMT predicts cardiovascular outcomes, examination of these clinical markers in relation to future cardiovascular events is